



Designation: D7187 – 20

Standard Test Method for Measuring Mechanistic Aspects of Scratch/Mar Behavior of Paint Coatings by Nanoscratching¹

This standard is issued under the fixed designation D7187; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers a nanoscratch method for determining the resistance of paint coatings on smooth flat surfaces to scratch/mar.

1.2 Other methods used in scratch/mar evaluation physically scratch or mar a sample's surface with single or multiple contact cutting, and then use visual inspection to assign a ranking. It has been recognized that loss of appearance is mainly due to surface damage created. This method quantitatively and objectively measures scratch/mar behavior by making the evaluation process two steps with emphasis on surface damage. Step one is to find the relationship between damage shape and size and external input (such as forces, contact geometry, and deformation). Step two is to relate damage shape and size to visual loss of luster. The first step is covered by this method; in addition, a survey in the appendix provides an example of an experiment to relate the damage to the change in luster.

1.3 There are three elementary deformation mechanisms: elastic deformation, plastic deformation and fracture; only the latter two contribute significantly to mar. This method evaluates scratch/mar based on the latter two damage mechanisms.

1.4 Although this standard was developed for paint coatings, it can also be applied to other types of similar polymer-based coatings, for example, lacquers, varnishes, glazes and other decorative and protective layers deposited on hard substrates.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

¹ This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.23 on Physical Properties of Applied Paint Films.

Current edition approved June 1, 2020. Published June 2020. Originally approved in 2005. Last previous edition approved in 2015 as D7187 – 15. DOI: 10.1520/D7187-20.

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

- D609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products
- D823 Practices for Producing Films of Uniform Thickness of Paint, Coatings and Related Products on Test Panels
- D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
- D1044 Test Method for Resistance of Transparent Plastics to Surface Abrasion by the Taber Abraser
- D3363 Test Method for Film Hardness by Pencil Test (Withdrawn 2020)³
- D3924 Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials
- D5178 Test Method for Mar Resistance of Organic Coatings
- D6037 Test Methods for Dry Abrasion Mar Resistance of High Gloss Coatings
- D6279 Test Method for Rub Abrasion Mar Resistance of High Gloss Coatings
- D7027 Test Method for Evaluation of Scratch Resistance of Polymeric Coatings and Plastics Using an Instrumented Scratch Machine
- D7091 Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals
- G171 Test Method for Scratch Hardness of Materials Using a Diamond Stylus

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *ASTM Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.